CLAIMS

1. A method of forming a MEMS device, the method comprising:

depositing a conductive material on a substructure;

forming a first sacrificial layer over the conductive material, including forming a substantially planar surface of the first sacrificial layer;

forming a first element over the substantially planar surface of the first sacrificial layer, including communicating the first element with the conductive material through the first sacrificial layer;

forming a second sacrificial layer over the first element, including forming a substantially planar surface of the second sacrificial layer;

forming a support through the second sacrificial layer to the first element after forming the second sacrificial layer, including filling the support;

forming a second element over the support and the substantially planar surface of the second sacrificial layer; and

substantially removing the first sacrificial layer and the second sacrificial layer, including supporting the second element relative to the first element with the support.

2. The method of claim 1, wherein forming the second element includes forming the second element with a substantially planar surface over an entirety thereof.

3. The method of claim 1, wherein forming the first element includes forming openings in the first sacrificial layer to the conductive material, depositing a first material within the openings and on the substantially planar surface of the first sacrificial layer, depositing and patterning a protective material on the first material, and depositing a second material on the protective material and the first material, and includes removing a portion of the second material and the protective material to expose a portion of the first material.

4. The method of claim 1, wherein forming the support includes forming an opening through the second sacrificial layer to the first element, depositing a protective material within the opening, and filling the opening with a plug material.

5. The method of claim 4, wherein forming the opening through the second sacrificial layer includes etching the second sacrificial layer.

6. The method of claim 1, wherein filling the support includes filling the support with a plug material, and wherein forming the second element includes contacting the plug material with the second element.

7. The method of claim 1, wherein substantially removing the first sacrificial layer and the second sacrificial layer includes etching the first sacrificial layer and the second sacrificial layer.

8. The method of claim 7, wherein etching the first sacrificial layer and the second sacrificial layer includes dry etching the first sacrificial layer and the second sacrificial layer.

9. The method of claim 1, wherein forming the first sacrificial layer includes depositing one of silicon, an oxide, and photoresist over the conductive material.

10. The method of claim 1, wherein forming the second sacrificial layer includes depositing one of silicon, an oxide, and photoresist over the first element.

11. The method of claim 1, wherein filling the support includes depositing one of silicon, an oxide, a metal, and photoresist within the support.

12. The method of claim 1, wherein the substructure includes a base material and at least one conductive layer formed on the base material, and wherein depositing the conductive material on the substructure includes communicating the conductive material with the at least one conductive layer of the substructure.

13. The method of claim 12, wherein the base material of the substructure includes silicon and the at least one conductive layer of the substructure includes aluminum.

14. The method of claim 1, wherein the substructure includes a complementary metal oxide semi-conductor structure.

15. A method of forming a micro-mirror device, the method comprising:

depositing a conductive material on a substructure;

forming a first layer of sacrificial material over the conductive material;

forming a hinge element over the first layer of sacrificial material, including communicating the hinge element with the conductive material through the first layer of sacrificial material;

forming a second layer of sacrificial material over the hinge element;

forming a plugged via through the second layer of sacrificial material to the hinge element after forming the second layer of sacrificial material;

forming a reflective element over the plugged via and the second layer of sacrificial material; and

substantially removing the first layer and the second layer of sacrificial material, including supporting the reflective element relative to the hinge element with the plugged via.

16. The method of claim 15, wherein forming the reflective element includes forming the reflective element with a substantially planar surface over an entirety thereof.

17. The method of claim 15, wherein forming the hinge element includes forming openings in the first layer of sacrificial material to the conductive material, depositing a first material within the openings and over the first layer of sacrificial material, depositing and patterning a protective material on the first material, and depositing a second material over the protective material and the first material, and includes removing a portion of the second material and the protective material to expose a portion of the first material.

18. The method of claim 15, wherein forming the plugged via includes forming an opening through the second layer of sacrificial material to the hinge element, depositing a protective material within the opening, and filling the opening with a plug material.

19. The method of claim 18, wherein forming the opening through the second layer of sacrificial material includes etching the second layer of sacrificial material.

20. The method of claim 18, wherein forming the reflective element includes contacting the plug material of the plugged via with the reflective element.

21. The method of claim 18, wherein the plug material of the plugged via includes one of silicon, an oxide, a metal, and photoresist.

22. The method of claim 15, wherein substantially removing the first layer and the second layer of sacrificial material includes etching the first layer and the second layer of sacrificial material.

23. The method of claim 22, wherein etching the first layer and the second layer of sacrificial material includes dry etching the first layer and the second layer of sacrificial material.

24. The method of claim 15, wherein the sacrificial material includes one of silicon, an oxide, and photoresist.

25. The method of claim 15, wherein the substructure includes a base material and at least one conductive layer formed on the base material, and wherein depositing the conductive material on the substructure includes communicating the conductive material with the at least one conductive layer of the substructure.

26. The method of claim 25, wherein the base material of the substructure includes silicon and the at least one conductive layer of the substructure includes aluminum.

27. The method of claim 15, wherein the substructure includes a complementary metal oxide semi-conductor structure.

28. A micro-mirror device, comprising:

a substructure;

conductive material patterned on the substructure;

a hinge element supported over the substructure and communicated with the conductive material;

a reflective element supported over the hinge element; and

a support extended between the hinge element and the reflective element,

wherein the support is filled with a plug material, and the reflective element contacts the plug material.

29. The device of claim 28, wherein the reflective element has a substantially planar surface over an entirety thereof.

30. The device of claim 28, further comprising:

a first sacrificial layer formed over the conductive material, wherein the hinge element is adapted to be formed over the first sacrificial layer; and

a second sacrificial layer formed over the hinge element, wherein the reflective element is adapted to be formed over the second sacrificial layer,

wherein the first sacrificial layer and the second sacrificial layer are adapted to be removed by an etch process after the hinge element and the reflective element are formed.

31. The device of claim 30, wherein the etch process includes a dry etch process.

32. The device of claim 30, wherein the second sacrificial layer is adapted to have an opening formed therein to the hinge element, wherein the support is adapted to be formed in the opening and filled with the plug material before the reflective element is formed over the second sacrificial layer, and wherein the reflective element is adapted to be formed over the second sacrificial layer and the plug material.

33. The device of claim 32, wherein the plug material is adapted to be planarized before the reflective element is formed over the second sacrificial layer and the plug material.

34. The device of claim 30, wherein the first sacrificial layer and the second sacrificial layer include one of silicon, an oxide, and photoresist.

35. The device of claim 28, wherein the plug material includes one of silicon, an oxide, a metal, and photoresist.

36. The device of claim 28, wherein the support constitutes a conductive via extended between the hinge element and the reflective element.

37. The device of claim 28, wherein the substructure includes a base material and at least one conductive layer formed on the base material, wherein the conductive material communicates with the at least one conductive layer of the substructure.

38. The device of claim 37, wherein the base material of the substructure includes silicon and the at least one conductive layer of the substructure includes aluminum.

39. The device of claim 28, wherein the substructure includes a complementary metal oxide semi-conductor structure.

40. A display device including the micro-mirror device of claim 28.

41. A micro-mirror device, comprising:

a substructure;

conductive material patterned on the substructure;

a hinge element extended over the substructure and communicated with the conductive material;

a reflective element extended over the hinge element; and

means for supporting the reflective element relative to the hinge element, including means for forming the reflective element with a substantially planar surface over an entirety thereof.

42. The device of claim 41, wherein means for supporting the reflective element includes a support extended between the hinge element and the reflective element.

43. The device of claim 42, wherein the support constitutes a conductive via extended between the hinge element and the reflective element.

44. The device of claim 42, wherein means for forming the reflective element with a substantially planar surface includes a plug material filled within the support, wherein the reflective element is formed over and contacts the plug material.

45. The device of claim 44, wherein the plug material includes one of silicon, an oxide, a metal, and photoresist.